PCS Applications

Outputs

- Technical contributions to an industry-developed inter-PCS interference standard for predicting, identifying, and alleviating interference related problems.

- Interference models for the PCS technologies currently in use, as well as proposed third generation (3G) systems.

Personal Communications Services (PCS) is widely used for mobile voice and data communications and is becoming an important resource for implementing emergency telecommunication services following a natural or man-made disaster. Several factors contribute to diminished channel capacity of a wireless network. A major limiting factor of channel capacity is co-channel interference for channels in the same technology. Another stress on channel capacity occurs from multiple, independent, non-interoperable systems that service the same geographical area, often using the same frequency bands and infrastructure (base station sites and towers). In addition, natural and man-made disasters can damage the terrestrial telecommunication system, forcing users to migrate to cellular resources. This sudden influx of traffic by private, commercial, civil, and Federal users results in wireless system overloads, a decrease in signal quality, and disruption of service in the affected area. National security/emergency preparedness (NS/EP) planners and network operators must understand these interference effects to operate effectively in an overloaded environment.

ITS contributes to understanding inter-PCS interference by participating in the Telecommunications Industry Association (TIA) committee TR46.2 (Mobile & Personal Communications 1800-Network Interfaces). Through this committee, ITS helps develop the Technical Service Bulletin "Licensed Band PCS Interference." This bulletin is a first step in characterizing the interfering environment caused by large numbers of active users and competing technologies.

However, this work requires tools to characterize the interference experienced by PCS air-interface signals. PCS interference models are tools that can be used to predict levels of interference and identify sources of interference. Information from simulations or simulators fed by these models can be used to develop methods to alleviate existing interference problems and even avoid future interference problems. Several standard propagation models are accepted by industry members (i.e., Okumura and COST-231/Walfish/Ikegami) but no interference models have been developed or accepted. ITS is developing a series of PCS interference models starting with a model based on the ANSI/TIA/EIA-95B standard (Rusyn 2002, see **Recent Publication** on next page). The model covers system-specific interference modeling to determine co-channel interference from both immediate and adjacent cells.
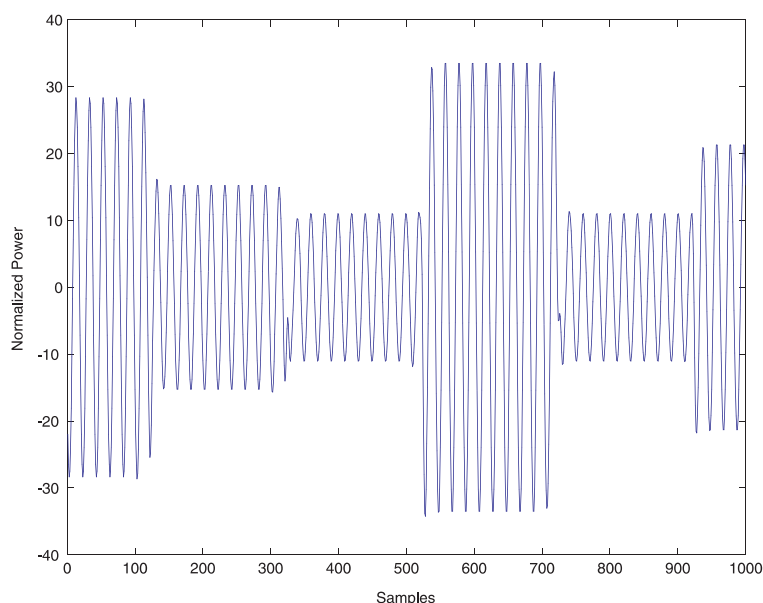

Figure 1. The output of the ITS models can be used in either software- or hardware-based simulations.

The output of the physical model is a sampled modulated signal which is the composite of the signals transmitted from all sources identified in a specified scenario. Software- and hardware-based simulations can use the sampled signal from the model to evaluate system designs (see Figure 1). These simulations can characterize one-on-one, one-on-many, and many-on-one interference. As a result, potential solutions to congestion can be proposed to solve existing problems or to anticipate and avoid potential problems. ITS is currently working on the verification and validation of the first, ANSI 95-B, model. The validation process will include both software and hardware aspects of the model.

The ANSI 95-B model is the first in a series of models that will include third generation (3G) systems. The communications industry has proposed and developed new technologies to address system limitations such as system capacity, coverage, and data transfer rates. 3G systems have been proposed to support the goals established by the International Telecommunication Union (ITU) with IMT-2000. These systems include cdma2000 and W-CDMA, known as UTRA (Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access) in Europe. These technologies present new issues for the existing PCS networks. The new 3G systems will need to coexist with current PCS systems for a period of time. The series of ITS models will include cdma2000 and W-CDMA. All of the new models are being developed such that the output data from the models will be compatible with the output data from the other models in the series; this will allow users to characterize potential problems between the different technologies as the 3G systems are implemented as well as characterizing interference problems with the existing PCS networks (see Figure 2).
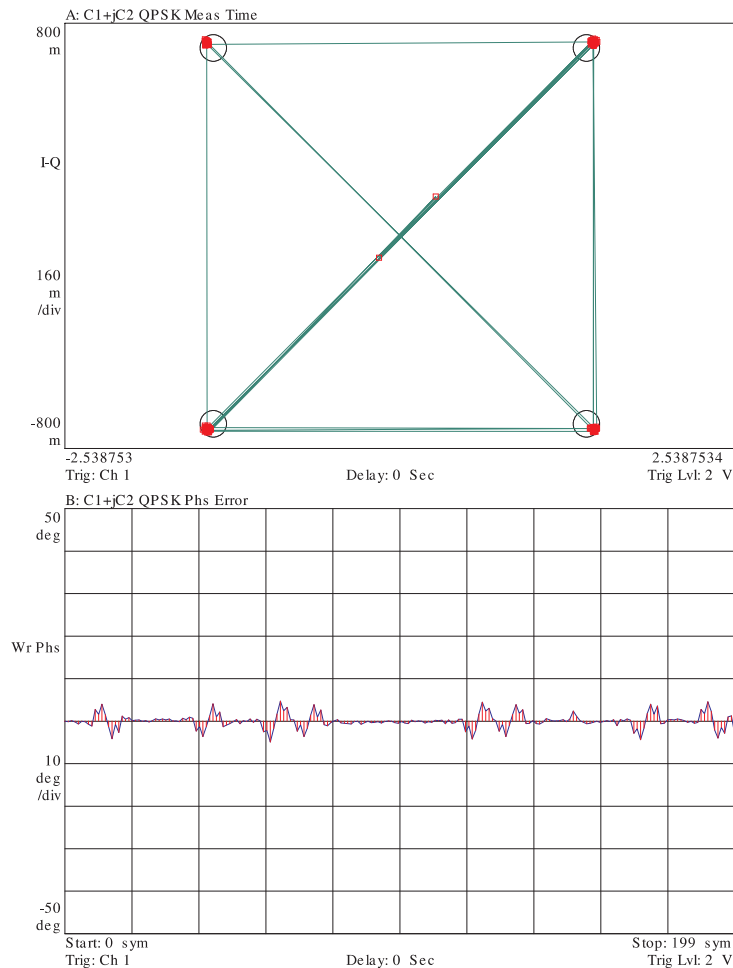

Figure 2. The ITS model can show properties of a PCS signal such as the phase error shown here.

Recent Publication

T.L. Rusyn, "Co-channel interference modeling of the ANSI/TIA/EIA-95-B Code Division Multiple Access cellular system," in *Proc. 2002 IEEE EMC Symposium*, Minneapolis, MN, Aug. 2002.

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